

PROJECT INSTRUCTION
SHROUD REPAIR FOR H1 THROUGH H7 WELDS
FOR
PECO ENERGY
PEACH BOTTOM ATOMIC POWER STATION

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THE CONTENTS OF THIS REPORT**

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TABLE OF CONTENTS

1.0	SCOPE	1
2.0	REFERENCES	1
3.0	PROJECT OPERATIONS	3
4.0	DESIGN REQUIREMENTS	3
5.0	DESIGN	5
6.0	DESIGN ANALYSIS	5
7.0	OTHER EVALUATIONS	5
8.0	DESIGN FREEZE	5
9.0	DESIGN DOCUMENTATION	6
10.0	FABRICATION	6
11.0	INSTALLATION REQUIREMENTS	6
12.0	SAFETY ANALYSIS	6
13.0	HARDWARE DELIVERABLES	7
14.0	TOOLING	7
15.0	TRAINING	7
16.0	INSTALLATION	7
17.0	QUALITY ASSURANCE	7

1.0 SCOPE

This document establishes the technical and project administrative process to be used by the GE Nuclear Energy (GE) and PECO ENERGY (PECO) shroud repair project team. The process applies to the development of repair design(s) for the H1 through H7 shroud welds for the Peach Bottom Unit 2 reactor, including delivery and installation of the hardware at the site. Project work includes concept development, selection and approval, qualification of the design by analysis, approval of the design by both PECO and by GE, one NRC presentation, specification and procurement of materials, and fabrication of the repair hardware. Also included is the design, fabrication and qualification of the tooling including mockups and training, the installation of the repair including required inspections, and preparation of the appropriate PECO documents for installation.

All project activities shall be in accordance with GE Proposal No. 893-1ET2H-HE0 and PECO Purchase Order No. PB26384, unless mutually agreed and documented otherwise by PECO and GE Project Managers. Conflicts between this document and design specifications, design drawings, or any other documents pertaining to the shroud repair shall be brought to the attention of the GE Project Manager for resolution. This document records Customer Technical Requirements applicable to the shroud repair in accordance with GE Engineering Operating Procedure 25-4.00 and Procedure 10-12 of GE Nuclear Energy Policies and Procedures.

2.0 REFERENCES

- 2.1 General Electric Documents. The following GE documents apply to the design, qualification, and fabrication of shroud repair components. The list below is not all inclusive and may be expanded as the project progresses.

<u>Subject</u>	<u>Document Number</u>
a. Arc Welding of Austenitic Stainless Steel	P50YP102
b. Seismic Analysis of Peach Bottom 2 Reactor Vessel and Internals	383HA691 Rev. 0
c. Sensitization Tests for Austenitic Stainless Steel, Modified ASTM A262 Practice E	E50YP13
d. Reload Seismic Analysis - Peach Bottom 2 and 3	386HA474 Rev. 0
e. Determination of Carbide Precipitation in Wrought Austenitic Stainless Steel (Modified ASTM A262 Practice A)	E50YP20
f. Proposal for RPV Core Shroud Repair for Peach Bottom Atomic Power Station	GE Proposal No. 893-1ET2H-HE0
g. Examination for Intergranular Attack	E50YP11
h. Age Hardening of NI-CR-FE Alloy X-750	P10JYP2
i. Liquid Penetrant Examination	E50YP22A

2.2 Codes and Standards The following documents of the latest issue (or specified issue) apply to the design, qualification, and fabrication of shroud repair components.

2.2.1 American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel (B&PV) Code

- a. Section III, Appendices, 1989 Edition
- b. Section IX, Welding and Brazing Qualifications, 1989 Edition
- c. Section III, Subsection NG, 1989 Edition
- d. Section XI, Rules for Inservice Inspection, 1980 Edition with Addenda through Winter 1981
- e. Section III, 1965 Edition with Addenda through Winter 1965

2.2.2 American Society for Testing & Materials (ASTM)

- a. ASME A182, Specification for Forged or Rolled Alloy-Steel Pipe Flanges, Forged Fittings, and Valves and Parts for High Temperature Service.
- b. ASTM A240, Specification for Heat Resisting Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels.
- c. ASTM A276, Specification for Stainless and Heat Resisting Steel Bars and Shapes.
- d. ASTM A479, Specification for Stainless and Heat-Resisting Steel Bars and Shapes for Use in Boilers and Other Pressure Vessels.
- e. ASME A480, Specification for General Requirements for Flat-Rolled Stainless and Heat Resisting Steel Plate, Sheet and Strip.
- f. ASTM B637, Specification for Precipitation Hardening Nickel Alloy Bars, Forgings, and Forging Stock for High Temperature Service.
- g. ASTM A262, Standard Practices for Detecting Susceptibility to Intergranular Attack in Austenitic Stainless Steels.

2.3 PECO Energy Documents

- a. Peach Bottom 2 and 3 UFSAR, Chapter 3 and Appendix C.
- b. PECO Energy Specification for RPV Core Shroud Repair, NE-225
- c. PECO Energy Purchase Order No. PB263848

3.0 PROJECT OPERATIONS

The repair design will be prepared by GE in consultation with PECO, in accordance with internal GE practice for Safety Related reactor internals; except that unverified working level information in the form of sketches, hand calculations, and drafts will be released to PECO prior to design verification and issue, as needed. This variance from normal GE practice for Safety Related equipment will be implemented in the interest of timely information exchange and on-schedule completion of project work which meets both GE and PECO requirements. Similarly, GE will order material and fabrication in advance of having some of the documentation formally in place in order to meet PECO schedule requirements. This process can only work if the project is carried out on a good faith, mutual trust basis which is assumed by both GE and PECO.

Design specifications, analyses, and fabrication drawings will be reviewed and approved by PECO. GE will support the PECO reviews by submitting a review package to PECO for each review topic, according to the Project Schedule. Review comments resolution will be handled in the most effective manner, i.e., the preferred method is by FAX and telephone conferences, but face to face working meetings in San Jose will be used if necessary. Whatever method is used, it will be in accordance with the Project Schedule. Changes requested by PECO which are beyond the project scope and schedules as agreed to, may result in additional time and material charges by GE.

GE will incorporate necessary changes, freeze the design, issue design documentation, and formally release procurement/fabrication on completion of the above process.

4.0 DESIGN REQUIREMENTS

Shroud circumferential welds H1 through H7 were originally required to provide vertical and horizontal support for the core top guide, core support plate and shroud head, and to prevent core flow bypass to the downcomer region in the shroud/RPV annulus. The core top guide and core support plate provide horizontal support for the fuel assemblies, and maintain the correct fuel channel spacing to permit control rod insertion. The purpose of the shroud repair is to structurally replace welds H1 through H7, assuming welds H1 through H7 are structurally ineffective due to cracking and/or cracking indications. The shroud repair will fulfill all of the original design requirements for the shroud as defined in the Peach Bottom 2 and 3 UFSAR. The shroud repair will be designed to support the top guide, core support plate, the fuel assemblies and the shroud head for all design conditions. The stabilizer assemblies and associated hardware will be designed for the remaining life of Peach Bottom 2 and 3, including possible life extension.

The replacement of welds H1 through H7 with the stabilizers will change the seismic response of the reactor internals. The existing seismic model will be modified to incorporate the effects of the stabilizers. The stabilizers will be sized to produce the minimum possible adverse affect on the seismic loads to the reactor internals. It is possible that the new seismic analysis, including the stabilizers, will increase the loads outside of the reactor pressure vessel and its supports. The consequences of these potentially increased loads on other components such as piping, will be evaluated.

The pressure differences across reactor internals shall be those values corresponding to the licensed increase in core flow and Power Rerate operation.

The shroud repair shall not produce an adverse impact on reactor or ECCS system performance. The shroud repair shall be removable, i.e., installed with bolted or quick disconnect connections to the shroud and shroud support plate. In-vessel welding is not permitted. Nuts and bolts shall be locked with mechanical devices instead of tack welds. The number of fasteners and fastener size shall be minimized.

The shroud repair components are classified as non-ASME code components consistent with the original shroud design. A Section XI Repair Plan is required to be prepared by PECO.

The shroud repair components are Safety Related components. Material procurement and fabrication shall be performed under a 10CFR50 Appendix B Program. 10CFR Part 21 applies to materials supplied to ASTM or ASME Specifications, which are acceptable for the repair components. CMTRs shall be provided for all components. Materials shall be resistant to IGSCC and IASCC (to the extent possible) in BWR water. Finished products shall be designed, fabricated, and installed according to processes and procedures which result in stress corrosion resistant components. Cold work shall be controlled to satisfy hardness requirements. Components made of annealed F304, F304L, F316, or F316L stainless steel material per ASTM (or ASME) A182, A240, A276, or A479 with a carbon content not to exceed 0.020% are acceptable. Materials should be provided with cobalt control (less than 1.0%) if the project schedule permits. Material properties shall be obtained from ASME Section III Appendices (Paragraph 2.2.1.a), and welding qualifications shall be performed per ASME Section IX (Paragraph 2.2.1.b).

The tie rods may be made of annealed XM-19 material per ASTM (or ASME) A479 with a carbon content not to exceed 0.04%.

The stabilizer springs shall be made of age hardened NI-CR-FE alloy X-750 per ASTM B637. The material shall be provided with cobalt control (less than 1.0%). The alloy X-750 material shall be age hardened per Paragraph 2.1.g.

Other parts such as pins, bolts, nuts, washers and retainers shall be made of any of the materials listed above, as required by the design. If ASTM A240 or A276 is used, the material must be annealed and the carbon content shall not exceed 0.020%.

Structural criteria, loads, load combinations, stress intensity limits, deflection limits, etc. will be derived considering the UFSAR for Peach Bottom 2 and 3 (Paragraph 2.3.a above). All design requirements will be formally documented in a design specification which is created, reviewed and approved in accordance with Paragraph 3.0. Installation requirements important to the design and satisfaction of all design criteria will be, in part, a result of the detailed design work performed to demonstrate that design requirements are met. Installation requirements will be set forth in an installation specification(s) discussed in Paragraph 11.0 below. The UFSAR will be updated as necessary to reflect the installation of the shroud stabilizers.

5.0 DESIGN

The repair design will be based on the original design load combinations, the revised seismic loads, and Power Rerate conditions. The prime consideration, beyond that of satisfying the basic requirements, will be to minimize the extent of in-vessel work and the critical path time needed for installation. The repair hardware will be designed so that it may be installed at either Peach Bottom Unit 2, or at Unit 3.

6.0 DESIGN ANALYSIS

Design analysis will be performed to demonstrate compliance with all design requirements. Seismic analysis will be performed taking into account new shroud stabilizers stiffness and mass, as well as degradation of the shroud welds. If possible, the number of stabilizer assemblies will not exceed 4, which will minimize the time needed for installation.

The design analyses for the stabilizer assemblies and shroud will be documented in a stress report. The ASME Code Section III, Subsection NG will be used as a guide for the design analysis of the shroud stabilizers and for the shroud. The forces imposed by the stabilizers on the reactor pressure vessel will be shown to be acceptable per the original ASME Code Section III requirements in a separate certified stress report. The stabilizer stress report and the certified stress report will be reviewed and approved according to Paragraph 3.0. The seismic analysis will be documented in a letter report separate from the design report. The seismic analysis results will also be reviewed and approved according to Paragraph 3.0.

7.0 OTHER EVALUATIONS

Evaluations will be performed to demonstrate that the repair produces no unacceptable impact on reactor operations, or ECCS performance, and that there will not be any unacceptable impact on other reactor internals. The effect of the stabilizers on other in-vessel servicing and inspection activities will be determined. All design required preinstallation inspections will be performed by GE. All required post installation inspections will be identified by GE.

8.0 DESIGN FREEZE

Design freeze signifies agreement by PECO and GE on all aspects of the repair design. Changes to the design, analyses, and/or fabrication which are outside GE control, are made subsequent to design freeze, and increase GE cost or extend the project-schedule shall be cause for re-negotiation.

9.0 DESIGN DOCUMENTATION

Design documentation provided under the firm price repair contract will include the following:

- Project Instruction (this document)
- Design Specification(s)
- Fabrication Specification
- Installation Specification
- Reactor Modification Drawing
- Modification Drawing Parts List
- Shroud Repair Product Drawings
- Cleaning and Cleanliness Control Specification
- Stress Report(s)
- Seismic Letter Report
- Safety Evaluation
- FDI

Supporting design information (calculations, etc.) required by PECO will be identified during the course of the project and will be provided on a schedule subsequent to that required for delivery of the hardware. This information was not specified at the start of the project, but will be provided as mutually agreed.

10.0 FABRICATION

Hardware and tooling fabrication requirements will be developed during the design process and will be reviewed and approved according to Paragraph 3.0.

11.0 INSTALLATION REQUIREMENTS

Installation requirements will be documented in an Installation Specification that will be developed during the design analysis process, and will be reviewed and approved according to Paragraph 3.0. Details of the installation will be provided by a modification drawing(s), with general instructions provided by a Field Disposition Instruction (FDI).

The installation will be performed using special purpose procedures developed under plant specific guidelines. The applicable Peach Bottom refueling floor procedures will be adhered to during the shroud repair installation.

12.0 SAFETY ANALYSIS

A 10CFR50.59 safety analysis document will be provided assessing the safety impact of the shroud repair addition. Submittals to the NRC will be provided by PECO. GE will support any required follow-up or additional meetings requested by the NRC.

13.0 HARDWARE DELIVERABLES

Conceptual hardware scope is as follows. The final scope will be determined following detailed analysis by GE.

<u>Item</u>	<u>Quantity</u>
Stabilizer Assemblies, consisting of top guide stabilizer core plate stabilizer tie rod upper and lower connections attachment devices	4 to 6

14.0 TOOLING

All required installation tooling will be designed, procured, fabricated, functionally tested, qualified for installation of the stabilizer assemblies, and shipped to the site. Testing will be performed on a full scale mock-up at the GE BWR Training Center in San Jose, California. New tooling will be developed using past lessons where possible. GE is responsible for providing all equipment necessary to support the project objective of minimizing repair duration.

15.0 TRAINING

A training plan will be prepared. All installation personnel will be trained on a full scale mock-up.

16.0 INSTALLATION

All necessary personnel to install the stabilizer assemblies per the installation requirements will be provided. The installation crew will consist of a Project Manager, Lead Field Engineers, Field Engineers, QA/QC Personnel, Tooling Specialists, EDM Engineers, FDM Operators, and all necessary Technicians. Design engineering assistance for hardware and tooling from San Jose will be provided as required.

17.0 QUALITY ASSURANCE

Quality Assurance for this project shall be in accordance with the Quality Assurance Section of GE Proposal No. 893-1ET2H-HE0.